

**APPARATUS AND METHOD FOR MANUFACTURING RECLOSEABLE BAGS  
UTILIZING ZIPPER TAPE MATERIAL**

This application is based on and claims priority from U.S. Provisional Application Serial No. 60/250,885, filed November 7, 2000.

**FIELD OF INVENTION**

The present invention relates to an apparatus and method for sealing zipper tape to a web of flexible film in an airtight manner.

**BACKGROUND OF THE INVENTION**

The popularity of reclosable zipper fasteners has created a demand for a large number and wide variety of reclosable bag sizes and types. It is commonly known in the art to form a reclosable bag through the addition of a zipper strip to a pair of bag walls in order to form a bag with a reclosable, airtight seal. Transverse application of such zipper strips to a web of flexible film (such as a web of plastic material) is also known in the art.

In many reclosable bag applications, an airtight seal is necessary in order to maintain the freshness and integrity of items stored within the bag. However, presently available reclosable bags do not provide or maintain an airtight seal as a result of leakage through the ends of the zipper strips, leakage through the seal between the strip and the web, or leakage through the interlocked fastener profiles of the zipper strips themselves. There is thus a need for an apparatus and method for sealing a zipper strip to a web that reduces or eliminates the foregoing leaks. There is also a need for an apparatus and method for repeatedly and quickly sealing zipper tape to a web to allow for high-speed production of a web with pre-installed zipper-tape to make the production of reclosable bags commercially viable.

Commonly known methods of construction and seal formation often cause inaccurate, commercially unacceptable seals that cannot be produced on an economically practical scale.

Commonly known zipper strip formation methods require multiple sealing devices, precise machinery or extensive retooling to alter the size and type of reclosable fastener. Examples of such devices and methods are described in United States Patent Nos. 5,601,368 (Bodolay), 3,847,711 (Howard), 5,461,845 (Yeager), 4,241,865 (Ferrell), 4,335, 817 (Bahr), 4,909,017 (McMahon) and 5,024,537 (Tilman). None of the foregoing devices and methods satisfy the need for a multi-purpose reclosable zipper strip that can be accurately and economically sealed in an airtight manner to a web of flexible film.

#### **BRIEF SUMMARY OF THE INVENTION**

The present invention overcomes the shortcomings of the foregoing prior art devices and meets the foregoing needs by providing an apparatus and method for accurately sealing a multi-purpose reclosable zipper strip to a web of flexible film in an airtight manner. Moreover, the inventive apparatus and method is capable of repeatedly performing the steps necessary to seal tape to web with high throughout and with low cycle times.

Generally, the apparatus and method utilizes a zipper tape having airtight splotch seals fused in series along desired lengths of the zipper tape. The zipper tape is dispensed through a feeding mechanism and, when an optical sensor detects one of the splotch seal portions of the zipper tape, a desired length of zipper tape is advanced over an elevator platform. A knife is then signaled to descend and sever the advanced portion of zipper tape, which is thus deposited onto the elevator platform.

As the selected portion of the zipper tape is being positioned and deposited onto the elevator, the web is being positioned above the platform. A sealing head is then positioned over the web, while at the same time the elevator platform is driven upwardly so that the zipper tape portion positioned thereon comes into contact with the web. The heat passing through the web

from the sealing head is sufficient to seal the peripheral portions of the zipper tape section to the web, thereby creating an airtight seal between the zipper tape portion and the web.

#### **DESCRIPTION OF THE DRAWINGS**

Figure 1 is a front perspective view of a preferred embodiment of the apparatus of invention for sealing zipper tape to a web of flexible film;

Figure 2 is a partial front perspective view of the apparatus of Figure 1 showing a pneumatically-actuated elevator for placing the zipper tape of the present invention against the web;

Figure 3 is a partial front perspective view of the apparatus of Figure 1 showing the pneumatically-activated elevator of Figure 2 having an opening in the center thereof for reception of a sealing head from above the web;

Figure 4 is a top perspective view of a sealing head and perforation die positioned above the web, with the sealing head positioned to the side of the elevator and the perforation die positioned over the elevator;

Figure 5 is a top perspective view of a sealing head and perforation die positioned above the web, with the sealing head positioned over the elevator and the perforation die positioned to the side of the elevator;

Figure 6 is a side perspective view of the apparatus of Figure 1;

Figure 6A is a front plan view of the apparatus of Figure 1;

Figure 6B is a front perspective view of a computer used to control the apparatus of Figure 1;

Figure 7 is a front plan view of a bag manufactured using the present invention;

Figure 8 is a side cutaway view of the bag of Figure 7;

Figure 9 is a front perspective view of the preferred embodiment of the zipper tape of the present invention showing the fastener profiles of the first and second fastener strips;

Figure 10 is a front perspective view of the zipper tape of Figure 9 showing a series of interconnected zipper tape sections having splotch sections between each section; and

Figure 11 is a front perspective view of a zipper tape application device applying tape to a web of film that is subsequently wound on a winder for later use in a bagging machine.

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

The preferred embodiment of inventive apparatus 120 (best shown in Figures 1 and 6) is capable of accurately sealing a multi-purpose reclosable zipper strip 100 to a web 110 of flexible film in an airtight manner. Moreover, apparatus 120 is capable of repeatedly performing the steps necessary to seal tape 100 to web 110 with high throughout and with low cycle times.

Zipper tape 100 is preferably constructed of polyethylene and may also include additives such as ethylene acetate to facilitate easy sealing. Web 110 is also preferably constructed of polyethylene, but may be constructed of other commonly known films, such as polypropylene or polyethylene terephthalate (Saran®), or any other material providing a sealing layer that is compatible with the zipper tape 100.

As shown in Figure 9, zipper tape 100 comprises (1) a continuous supply of first profile strip 100A; and (2) a continuous supply of second profile strip 100C opposite the first profile strip 100A. The first profile strip 100A includes at least one rib 100B protruding from and along the length of the inner surface of first profile strip 100A. The second profile strip 100C includes at least two ribs 100D and 100E for sealably receiving rib 100B. Ribs 100D and 100E protrude from and along the length of the inner surface of second profile strip 100C. As shown in Figure

10, a series of splotch seal portions 100F are fused along desired lengths of the first profile strip 100A, the second profile strip 100C, and ribs 100B, 100D, and 100E.

As seen in Figure 6, zipper tape 100 is stored on roll 130, from which it is fed through apparatus 120 by a servometer 140, which controls the acceleration, speed and deceleration of zipper tape 100's movement through apparatus 120. Zipper tape 100 is wound through a series of dancer rollers 150 on arm 160, which allow zipper tape to be fed into feeding mechanism 170 at the desired tension. In a preferred embodiment, a photosensor 162 reads the position of the dancer arm 160 and, when the arm is descended to a desired position, advances zipper tape 100 using nip drive 166.

Feeding mechanism 170 utilizes an optical sensor 180 to detect the presence of the splotch seal portions 100F. Optical sensor 180 detects the thickness of the zipper tape 100 and is thus able to detect and distinguish each splotch seal portions 100 because such portions are thinner than the remainder of zipper tape 100. The splotch seal portions 100 thus act as eye marks to indicate the position of zipper tape 100.

When optical sensor 180 detects one of the splotch seal portions 100F of zipper tape 100, it signals belt tracks 340 and 350 (see Figure 3), which utilize belt drive 360 to advance a desired length of zipper tape 100 over elevator 230. In the preferred embodiment, optical sensor 180 utilizes a piezo-electric bridge 390 (Figure 6) to convert changes in opacity of the zipper tape 100 at the thinned portions (splotch seal sections 100F) to an electrical signal to advance zipper tape a desired length. Guillotine knife 370, driven by another servomotor 410, is then signaled to descend and cut portion 390 of zipper tape 100. Section 390 of zipper tape 100 thus positioned over and deposited onto elevator 230. Both the operation of belt drive 360 and guillotine knife

can be sequenced using pneumatic control devices such as those Matrix Technologies or by utilizing a computer control system such as those manufactured by Allen Bradley.

As shown in Figure 3, in a preferred embodiment, the top surface of elevator 230 comprises a rectangular platform 240 for receiving section 390 of zipper tape 100. As the selected portion 290 of zipper tape 100 is being positioned and deposited onto platform 240 in the foregoing manner, web 100 is being positioned above platform 240 as shown in Figure 4. A series of eye marks is printed along one edge of web 100 and are detected by a second optical sensor 190. A roll of web 100 is advanced through apparatus 120 by a series of roll drivers 200, which are driven by a second servomotor 210. The speed of drive rollers 200 is coordinated by the sensor 190 and a computer 220 (shown in Figure 6B), so that a desired portion of web 110 is positioned over elevator 230 to receive the selected portion 390 of zipper tape 100.

In one embodiment, web 110 is mounted on a roller 530 (see Figure 6). As web 110 is pulled through a series of dancer rolls 540 (Figure 3) mounted on arm 560, drive rollers 570 (Figure 6A) pull web 100 therethrough. When additional web material is pulled through rollers 570, the upstream dancer arm 520 rises, causing coils 522 in springs 524 to stretch under tension. When the arm 520 reaches a preset position, drive rollers 520 are deactivated. The coils under tension pull the arm 520 down to receive the material being advanced through the three-loop dancer roll assembly 540 and the process is then repeated.

In the preferred embodiment, elevator 240 is contained within a hollow Lexan® pedestal 242 defining a central opening 244 in which the elevator is 240 is positioned. A pair of rectangular ledges 248 and 249 are located at the top of pedestal 242. When the selected portion of web 110 is fed into position over elevator 240, the selected portion of web 110 extends over and between ledges 248 and 249.

As shown in Figure 4, a pneumatically-controlled sealing head 270 is mounted on block 280, which in turn is slidably mounted on shaft 291. As shown in Figure 4, sealing head 270 and block 280 are positioned above ledges 248 and 249 and to the side of platform 240. Following the deposit of section 290 of zipper tape onto platform 240 and the positioning of web 110 above platform 240, block 280 is driven horizontally by air cylinder 320 until sealing head 270 is positioned above platform 240 and, preferably, in contact with web 110. Sealing head 270, which is preferably Teflon® coated, is then either heated to the desired sealing temperature or is maintained at the desired sealing temperature.

At the same time, elevator 230 is driven upwardly by shaft 400 until platform 240 (and the zipper tape portion 390 thereon) is in contact with web 110. The heat passing through the web 110 from the sealing head 270 is sufficient to seal the peripheral portions of portion 290 of zipper tape 100 (as seen in Figure 10) to web 110, thereby sealing the zipper tape portion 290 positioned on the platform to web 110. Sealing head 270 further aids in creating the seal by providing a stable surface against which the elevator 230 can compress the web 110 and zipper tape portion 290.

The resulting seal is airtight due to the construction of zipper tape 100, which has thickened flanges 100G that melt and fill any gaps during sealing. Section 290 of zipper tape 100 is also airtight throughout the zipper portions because of the unique construction of the zippers themselves, as disclosed in parent U.S. Patent Application Serial No. 09/415,696, incorporated herein by reference.

In one embodiment, a pneumatically controlled perforation knife is mounted to block 270. When air cylinder 300 is actuated, perforation knife 260 descends downwardly so that knife 260 perforates web 110 between ledges 248 and 249, which serve as an anvil against which

web 110 is severed by knife 260. The air cylinder 300 then retracts perforation knife. In a preferred embodiment, sealing head 270 and perforation knife 260 may be combined so that the perforation of web 110 and the sealing of zipper tape portion 290 may be accomplished simultaneously. Alternatively, the sealing head 270 can be moved into place over platform 240 after the web has been severed by knife 260. In another embodiment, web 110 is not perforated, but is fed and wound onto a winder 80 to create a zippered roll stock 590 with zipper tape already sealed on base web for later use in a bagging machine 510 (see Figure 11).

While the present invention has been disclosed in terms of the preferred embodiments in order to facilitate better understanding of the invention, it should be appreciated that the invention can be embodied in various ways without departing from its basic principles. Therefore, the invention should be understood to include all possible embodiments and modifications to which do not depart from the invention as set out in the appended claims.